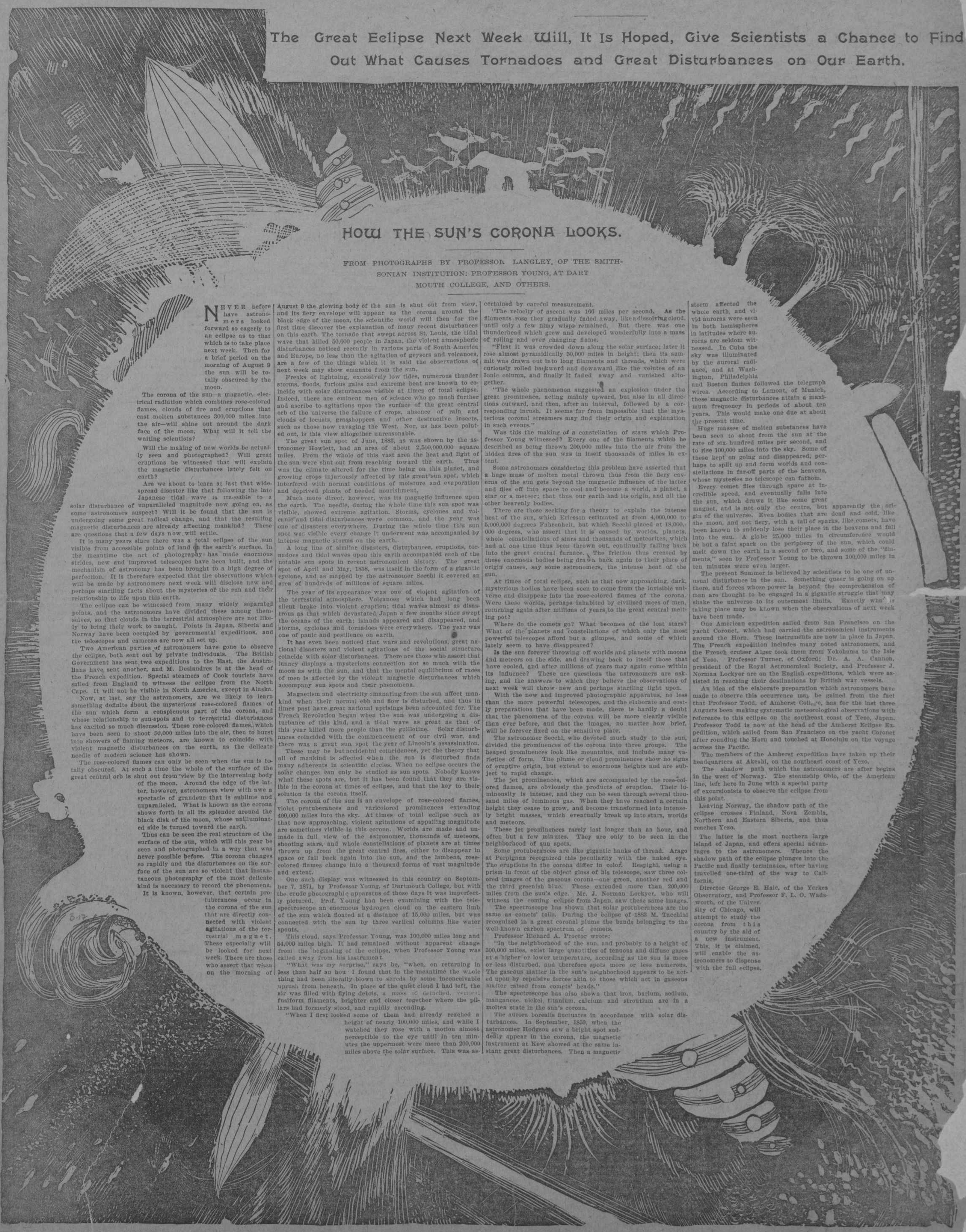
THE STRANGE MYSTERIES OF THE SUN'S CORONA.

The Great Eclipse Next Week Will, It Is Hoped, Give Scientists a Chance to Find Out What Causes Tornadoes and Great Disturbances on Our Earth.



HOW THE SUN'S CORONA LOOKS.

FROM PHOTOGRAPHS BY PROFESSOR LANGLEY, OF THE SMITHSONIAN INSTITUTION: PROFESSOR YOUNG, AT DARTMOUTH COLLEGE, AND OTHERS.

NEVER before have astronomers looked forward so eagerly to an eclipse as to that which is to take place next week. Then for a brief period on the morning of August 9 the sun will be totally obscured by the moon.

The corona of the sun—a magnetic, electrical radiation which combines rose-colored flames, clouds of fire and eruptions that cast molten substances 300,000 miles into the air—will shine out around the dark face of the moon. What will it tell the waiting scientists?

Will the making of new worlds be actually seen and photographed? Will great eruptions be witnessed that will explain the magnetic disturbances lately felt on earth?

Are we about to learn at last that widespread disaster like that following the late Japanese tidal wave is traceable to a solar disturbance of unparalleled magnitude now going on, as some astronomers suspect? Will it be found that the sun is undergoing some great radical change, and that the resulting magnetic disturbances are already affecting mankind? These are questions that a few days now will settle.

It is many years since there was a total eclipse of the sun visible from accessible points of land on the earth's surface. In the meantime the art of photography has made enormous strides, new and improved telescopes have been built, and the mechanism of astronomy has been brought to a high degree of perfection. It is therefore expected that the observations which will be made by astronomers next week will disclose new and perhaps startling facts about the mysteries of the sun and their relationship to life upon this earth.

The eclipse can be witnessed from many widely separated points, and the astronomers have divided these among themselves, so that clouds in the terrestrial atmosphere are not likely to bring their work to naught. Points in Japan, Siberia and Norway have been occupied by governmental expeditions, and the telescopes and cameras are now all set up.

Two American parties of astronomers have gone to observe the eclipse, both sent out by private individuals. The British Government has sent two expeditions to the East, the Australians have sent another, and M. Deslandres is at the head of the French expedition. Special steamers of Cook tourists have sailed from England to witness the eclipse from the North Cape. It will not be visible in North America, except in Alaska.

Now, at last, say the astronomers, are we likely to learn something definite about the mysterious rose-colored flames of the sun which form a conspicuous part of the corona, and whose relationship to sun-spots and to terrestrial disturbances has excited so much discussion. These rose-colored flames, which have been seen to shoot 50,000 miles into the air, then to burst into showers of flaming meteors, are known to coincide with violent magnetic disturbances on the earth, as the delicate needle of modern science has shown.

The rose-colored flames can only be seen when the sun is totally obscured. At such a time the whole of the surface of the great central orb is shut out from view by the intervening body of the moon. Around the edge of the latter, however, astronomers view with awe a spectacle of grandeur that is sublime and unparalleled. What is known as the corona shows forth in all its splendor around the black disk of the moon, whose unilluminated side is turned toward the earth.

Thus can be seen the real structure of the surface of the sun, which will this year be seen and photographed in a way that was never possible before. The corona changes so rapidly and the disturbances on the surface of the sun are so violent that instantaneous photography of the most delicate kind is necessary to record the phenomena.

It is known, however, that certain protuberances occur in the corona of the sun that are directly connected with violent agitations of the terrestrial magnet. These especially will be looked for next week. There are those who assert that when on the morning of August 9 the glowing body of the sun is shut out from view, and its fiery envelope will appear as the corona around the black edge of the moon, the scientific world will then for the first time discover the explanation of many recent disturbances on this earth. The tornado that swept across St. Louis, the tidal wave that killed 50,000 people in Japan, the violent atmospheric disturbances noticed recently in various parts of South America and Europe, no less than the agitation of geysers and volcanoes, are a few of the things which it is said the observations of next week may show emanate from the sun.

Freaks of lightning, excessively low tides, numerous thunder storms, floods, furious gales and extreme heat are known to coincide with solar disturbances visible at times of total eclipse. Indeed, there are eminent men of science who go much further and ascribe to agitations upon the surface of the great central orb of the universe the failure of crops, absence of rain and clouds of locusts, grasshoppers and other destructive insects, such as those now ravaging the West. Nor, as has been pointed out, is this view altogether unreasonable.

The great sun spot of June, 1883, as was shown by the astronomer Howlett, had an area of about 2,500,000,000 square miles. From the whole of this vast area the heat and light of the sun were shut out from reaching toward the earth. Thus was the climate altered for the time being on this planet, and growing crops injuriously affected by this great sun spot, which interfered with normal conditions of moisture and evaporation and deprived plants of needed nourishment.

Much more direct, however, was its magnetic influence upon the earth. The needle, during the whole time this sun spot was visible, showed extreme agitation. Storms, cyclones and volcanic and tidal disturbances were common, and the year was one of disasters everywhere. During the whole time this sun spot was visible every change it underwent was accompanied by intense magnetic storms on the earth.

A long line of similar disasters, disturbances, eruptions, tornadoes and tidal waves upon this earth accompanied each of the notable sun spots in recent astronomical history. The great spot of April and May, 1858, was itself in the form of a gigantic cyclone, and as mapped by the astronomer Secchi it covered an area of hundreds of millions of square miles.

The year of its appearance was one of violent agitation of the terrestrial atmosphere. Volcanoes which had long been silent broke into violent eruption; tidal waves almost as disastrous as that which devastated Japan a few months since swept the oceans of the earth; islands appeared and disappeared, and storms, cyclones and tornadoes were everywhere. The year was one of panic and pestilence on earth.

It has even been noticed that wars and revolutions, great national disasters and violent agitations of the social structure coincide with solar disturbances. There are those who assert that lunacy displays a mysterious connection not so much with the moon as with the sun, and that the mental equilibrium of races of men is affected by the violent magnetic disturbances which accompany sun spots and their phenomena.

Magnetism and electricity emanating from the sun affect mankind when their normal ebb and flow is disturbed, and thus in times past have great national uprisings been accounted for. The French Revolution began when the sun was undergoing a disturbance of this kind, and a tidal wave as great as that of this year killed more people than the guillotine. Solar disturbances coincided with the commencement of our civil war, and there was a great sun spot the year of Lincoln's assassination.

These may be but accidental coincidences, yet the theory that all of mankind is affected when the sun is disturbed finds many adherents in scientific circles. When no eclipse occurs the solar changes can only be studied as sun spots. Nobody knows what these spots are, but it has been found that they are visible in the corona at times of eclipse, and that the key to their solution is the corona itself.

The corona of the sun is an envelope of rose-colored flames, violet protuberances and varicolored prominences extending 400,000 miles into the sky. At times of total eclipse such as that now approaching, violent agitations of appalling magnitude are sometimes visible in this corona. Worlds are made and unmade in full view of the astronomer, thousands of meteors, shooting stars, and whole constellations of planets are at times thrown up from the great central fires, either to disappear in space or fall back again into the sun, and the lambent, rose-colored flames change into a thousand forms of vast magnitude and extent.

One such display was witnessed in this country on September 7, 1871, by Professor Young, of Dartmouth College, but with the crude photographic apparatus of those days it was imperfectly pictured. Prof. Young had been examining with the telespectroscope an enormous hydrogen cloud on the eastern limb of the sun which floated at a distance of 15,000 miles, but was connected with the sun by three vertical columns like water spouts.

This cloud, says Professor Young, was 100,000 miles long and 54,000 miles high. It had remained without apparent change from the beginning of the eclipse, when Professor Young was called away from his instrument.

"What was my surprise," says he, "when, on returning in less than half an hour I found that in the meantime the whole thing had been literally blown to shreds by some inconceivable uprush from beneath. In place of the quiet cloud I had left, the air was filled with flying debris, a mass of detached, vertical fusiform filaments, brighter and closer together where the pillars had formerly stood, and rapidly ascending.

"When I first looked some of them had already reached a height of nearly 100,000 miles, and while I watched they rose with a motion almost perceptible to the eye until in ten minutes the uppermost were more than 200,000 miles above the solar surface. This was ascertained by careful measurement.

"The velocity of ascent was 166 miles per second. As the filaments rose they gradually faded away, like a dissolving cloud, until only a few slimy wisps remained. But there was one thunderhead which grew and developed wonderfully into a mass of rolling and ever changing flame.

"First it was crowded down along the solar surface; later it rose almost pyramidically 50,000 miles in height; then its summit was drawn out into long filaments and threads, which were curiously rolled backward and downward like the volutes of an Ionic column, and finally it faded away and vanished altogether.

"The whole phenomenon suggested an explosion under the great prominence, acting mainly upward, but also in all directions outward, and then, after an interval, followed by a corresponding inrush. It seems far from impossible that the mysterious coronal streamers may find their origin and explanation in such events."

Was this the making of a constellation of stars which Professor Young witnessed? Every one of the filaments which he described as being thrown 200,000 miles into the air from the hidden fires of the sun was in itself thousands of miles in extent.

Some astronomers considering this problem have asserted that a huge mass of molten metal thrown thus from the fiery caverns of the sun gets beyond the magnetic influence of the latter and flies off into space to cool and become a world, a planet, a star or a meteor; that thus our earth had its origin, and all the other heavenly bodies.

There are those seeking for a theory to explain the intense heat of the sun, which Ericsson estimated at from 4,000,000 to 5,000,000 degrees Fahrenheit, but which Secchi placed at 18,000,000 degrees, who assert that it is caused by worlds, planets, whole constellations of stars and thousands of meteorites, which had at one time thus been thrown out, continually falling back into the great central furnace. The friction thus created by these enormous bodies being drawn back again to their place of origin causes, say some astronomers, the intense heat of the sun.

At times of total eclipse, such as that now approaching, dark, mysterious bodies have been seen to come from the invisible universe and disappear into the rose-colored flames of the corona. Were these worlds, perhaps inhabited by civilized races of men, returning again after millions of years to the great central melting pot?

Where do the comets go? What becomes of the lost stars? What of the planets and constellations of which only the most powerful telescopes afford but a glimpse, and some of which lately seem to have disappeared?

Is the sun forever throwing off worlds and planets with moons and meteors on the side, and drawing back to itself those that have cooled, and after millions of years may again come within its influence? These are questions the astronomers are asking, and the answers to which they believe the observations of next week will throw new and perhaps startling light upon.

With the new and improved photographic apparatus, no less than the more powerful telescopes, and the elaborate and costly preparations that have been made, there is hardly a doubt that the phenomena of the corona will be more clearly visible than ever before, and that the images, no matter how brief, will be forever fixed on the sensitive plate.

The astronomer Secchi, who devoted much study to the sun, divided the prominences of the corona into three groups. The heaped prominences look like mountains, and include many varieties of form. The plume or cloud prominences show no signs of eruptive origin, but extend to enormous heights and are subject to rapid change.

The jet prominences, which are accompanied by the rose-colored flames, are obviously the products of eruption. Their luminousity is intense, and they can be seen through several thousand miles of luminous gas. When they have reached a certain height they cease to grow, and become transformed into intensely bright masses, which eventually break up into stars, worlds and meteors.

These jet prominences rarely last longer than an hour, and often but a few minutes. They are only to be seen in the neighborhood of sun spots.

Some protuberances are like gigantic hanks of thread. Arago at Perpignan recognized this peculiarity with the naked eye. The eruptions in the corona differ in color. Respighi, using a prism in front of the object glass of his telescope, saw three colored images of the gaseous corona—one green, another red and the third greenish blue. These extended more than 200,000 miles from the sun's edge. Mr. J. Norman Lockyer, who will witness the coming eclipse from Japan, saw these same images.

The spectroscope has shown that solar protuberances are the same as comets' tails. During the eclipse of 1883 M. Tacchini recognized in a great coronal plume the bands belonging to the well-known carbon spectrum of comets.

Professor Richard A. Proctor wrote:

"In the neighborhood of the sun, and probably to a height of 300,000 miles, exist large quantities of tenuous and diffuse gases at a higher or lower temperature, according as the sun is more or less disturbed, and therefore spots more or less numerous. The gaseous matter in the sun's neighborhood appears to be acted upon by repulsive forces akin to those which act in gaseous matter raised from comets' heads."

The spectroscope has also shown that iron, barium, sodium, manganese, nickel, titanium, calcium and strontium are in a molten state in the sun's corona.

The aurora borealis fluctuates in accordance with solar disturbances. In September, 1859, when the astronomer Hodgson saw a bright spot suddenly appear in the corona, the magnetic instrument at Kew showed at the same instant great disturbances. Then a magnetic storm affected the whole earth, and vivid auroras were seen in both hemispheres in latitudes where auroras are seldom witnessed. In Cuba the sky was illuminated by the auroral radiance, and at Washington, Philadelphia and Boston flames followed the telegraph wires. According to Lamont, of Munich, these magnetic disturbances attain a maximum frequency in periods of about ten years. This would make one due at about the present time.

Huge masses of molten substances have been seen to shoot from the sun at the rate of six hundred miles per second, and to rise 100,000 miles into the sky. Some of these kept on going and disappeared, perhaps to split up and form worlds and constellations in far-off parts of the heavens, whose mysteries no telescope can fathom.

Every comet flies through space at incredible speed, and eventually falls into the sun, which draws it like some great magnet, and is not only the centre, but apparently the origin of the universe. Even bodies that are dead and cold, like the moon, and not fiery, with a tail of sparks, like comets, have been known to suddenly lose their place in the heavens and fall into the sun. A globe 25,000 miles in circumference would be but a faint spark on the periphery of the sun, which could melt down the earth in a second or two, and some of the "filaments," seen by Professor Young to be thrown 100,000 miles in ten minutes were even larger.

The present Summer is believed by scientists to be one of unusual disturbance in the sun. Something queer is going on up there, and forces whose power is beyond the comprehension of man are thought to be engaged in a gigantic struggle that may shake the universe to its outermost limits. Exactly what is taking place may be known when the observations of next week have been made.

One American expedition sailed from San Francisco on the yacht Coronet, which had carried the astronomical instruments around the Horn. These instruments are now in place in Japan. The French expedition includes many noted astronomers, and the French cruiser Alger took them from Yokohama to the Isle of Yeso. Professor Turner, of Oxford; Dr. A. A. Cannon, president of the Royal Astronomical Society, and Professor J. Norman Lockyer are on the English expeditions, which were assisted in reaching their destinations by British war vessels.

An idea of the elaborate preparation which astronomers have made to observe this occurrence may be gained from the fact that Professor Todd, of Amherst College, has for the last three Augusts been making systematic meteorological observations with reference to this eclipse on the southeast coast of Yezo, Japan. Professor Todd is now at the head of the Amherst Eclipse Expedition, which sailed from San Francisco on the yacht Coronet after rounding the Horn and touched at Honolulu on the voyage across the Pacific.

The members of the Amherst expedition have taken up their headquarters at Akeshi, on the southeast coast of Yezo.

The shadow path which the astronomers are after begins in the west of Norway. The steamship Oslo, of the American line, left here in June with a special party of excursionists to observe the eclipse from this point.

Leaving Norway, the shadow path of the eclipse crosses Finland, Nova Zembla, Northern and Eastern Siberia, and thus reaches Yezo.

The latter is the most northern large island of Japan, and offers special advantages to the astronomers. Thence the shadow path of the eclipse plunges into the Pacific and finally terminates, after having travelled one-third of the way to California.

Director George E. Hale, of the Yerkes Observatory, and Professor F. L. O. Wadsworth, of the University of Chicago, will attempt to study the corona from this country by the aid of a new instrument. This, it is claimed, will enable the astronomers to dispense with the full eclipse.